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JANUARY, 1940

Editorial

At the beginning of a New Year we extend to our readers the Season's Greetings. Although the international situation must cast some gloom on all peoples the world over and the idea of progress may seem out of place at the present time, we must look ahead with courage and strength, making use of all our available knowledge, and it is in this spirit that we ask our readers to regard our efforts to keep them in touch with the happenings in the world of veterinary and allied sciences.

There is much that calls for comment concerning the position occupied by veterinary science in this and other countries. During the past twenty years or so we have seen changes which have resulted in a clearer conception of the cause, treatment and prophylaxis of many of the ailments affecting live-stock. The question now arises whether we are applying the available know-ledge to its fullest extent. The conservation of livestock of all kinds with its resultant effects on the amount of home-produced foodstuffs must be considered as all important.

Naturally, many circumstances have to be considered before it can be accepted that diseases merit control—economy being perhaps the most important. Still, taking a wide view of the situation, there seems little doubt

that fuller use can be made in controlling disease in general. It may be argued that, in some cases at least, the investigations into the best methods of treatment and control have not yet reached the stage which would justify their general adoption. This may be true in some instances, but it would still appear that the progress made in connection with the methods of control of some of the important diseases of our livestock is sufficient to-day to be applied on a large scale with reasonable prospect of successful results.

The investigation into the control of diseases must of necessity be a long, tedious and painstaking procedure, for every point must be proved to the most critical observer before it can be claimed as correct. It is the purpose and duty of established scientific journals to lay before their readers the results of research work and so to enable fair and candid opinions to be formed. During the following months it is hoped to devote space in THE VETERINARY JOURNAL to articles and accounts dealing with our knowledge of the position concerning the more important diseases.

The present seems an opportune time to review and comment upon methods of control which can be carried out by the veterinary profession, for, during this period of emergency, although the horse may yet prove to be of the same importance as it was in 1914-18, we must not neglect our home food supply. It is freely acknowledged by all that no matter how we treat our animals, the control of disease, no matter how simple, may be one of the important determining factors in the conservation of adequate supplies of meat, eggs, milk, etc.

If one looks back over the past twenty years one must be forcibly struck and pleased with the progress made concerning the wellbeing of livestock as a whole. Doubtless much remains to be done, but the general position is certainly cheerful.

The veterinary profession must take the lead in the application of the available methods of keeping livestock in a state of health and never was the time more opportune than to-day.

Not only can we control many of the diseases of livestock, we can also give attention to that great subject of animal husbandry in its widest scope. The profession is certainly in the position to undertake its full share—and perhaps the most important share—in the conservation of the livestock throughout the country and thus we can and must play our essential part in the present state of emergency.

Many of the schemes with which the veterinary profession was to be intimately associated may now be held over for the present. We have, however, our great and outstanding duty to perform now in the application of the latest available knowledge concerning the conservation of animals' lives: by so doing we shall be of much value to the country in the present crisis.

THE VETERINARY JOURNAL shall play its part by placing before its readers any information which may be forthcoming as well as summaries of the knowledge now available.

General Articles

BOTRYOMYCOSIS: SHOULDER TUMOUR IN THE HORSE

By HARRY LOMAS, M.R.C.V.S.

To those who have to do with large studs, this affection is sufficiently frequent and often so intractable as to cause considerable loss of service. Surgical methods do not always produce the happy results in the end which one sought to achieve.

The most usual situation for the tumour is about two or three inches above the point of the shoulder, and most commonly there is mere tumefaction without any sign of abscess; yet one does occasionally receive a case which shows early and definite abscess-formation. The writer regards the latter as being a fortunate circumstance since it will provide the material for taking a swab from which a vaccine may be prepared.

The swab should be sent to a bacteriologist, and if the report upon the resulting culture describes it as a pure one of a staphylococcus resembling the Micrococcus Ascoformans, then one may regard it as satisfactory. The vaccine may be used not only on the horse, from which it was derived, but also on any other cases, present and future, until the supply is exhausted. In the times when horses, and therefore cases, were more prevalent, it would not be long before there was another case giving hopes of another available supply; but failing this, there was always the possibility of borrowing a case from another infirmary. However, of late it has not been so easy to carry out this method by reason of the reduction in the size of studs.

Treatment by vaccine.—The dose is one c.c. and is injected under the skin of the breast over the pectoral muscles after thoroughly asepticising the parts; six days later a dose is injected into the opposite side, while for the third and last dose one reverts to the side where the first injection was made, choosing a spot which was not the exact site of the former injection as there may be a little swelling remaining.

There is always a local reaction, varying in size from two inches by one, to five or six by three, but these variations do not seem to have any significance whatever, and they have very often dispersed entirely by the fifth day.

Having given these injections, one begins to look for signs of retrogression in the size of the tumefaction about the sixteenth day, and it is quite

pleasing and remarkable to see the gradual subsidence that takes place, until from the 26th to the 32nd day there is practically no enlargement remaining, and the case can be discharged to resume work.

It is said that the exception proves the rule, and there is one in this case, or rather two. For instance, occasionally an abscess will mature during the process of treatment and it may be necessary to apply surgical measures. The latter will delay the resumption of work, but does not interfere with the cure. The other has regard to the matter of sub-cultures. In the past, when the primary vaccine was exhausted, one naturally applied for a further supply to be sub-cultured from the original which had done such good service. The products of sub-cultures did not give the same results—they were slower in reducing the tumour, or did not completely reduce it, and there were re-currents. Yet, when it was possible to make use of a primary culture on these recurrents, quite satisfactory results were obtained in about the same period of time.

This method has been in use since the year 1921; scores of cases have been treated and, with the exceptions noted, have remained free of this affection during their working life in London.

I am indebted to Drs. Annett and Mitchell, of Messrs. Evans Sons, Lescher and Webb, and also to Dr. Minett, of the Royal Veterinary College, for their kind assistance in the examination of swabs and the preparation of the vaccines which were used.

THE USE OF UREA IN VETERINARY PRACTICE

By J. McCUNN, M.R.C.V.S., M.R.C.S., L.R.C.P.
Royal Veterinary College.

It has been common knowledge for many centuries, and certainly from medieval times, that human urine is a good wound dressing. It prevents infection, restricts infection if that has occurred, and stimulates healing by the production of healthy granulation tissue. The writer has personal knowledge of the use of human urine by carmen and gipsies in the treatment of eczematous and suppurative lesions of the limbs of horses. Fresh urine is said to strengthen the limbs and prevent the occurrence of grease. I have seen bad cases of grease which have been bought by gipsies completely cured by applications of human urine and fæces.

With these facts in mind, I was very interested, about three or four years ago, to read an article by William Robinson which was published in the August, 1936, number of the *American Journal of Surgery*.

The title of the paper was, "Use of Urea to Stimulate Healing in Chronic Purulent Wounds." Robinson records a series of 14 cases in which beneficial

results followed the application of solutions of urea. These cases were of a chronic suppurative type which had not responded to the usual lines of treatment. Robinson used a 2 per cent. solution and he describes the results as the rapid clearance of pus, relief of pain and the closure of the wounds by healthy granulation tissue. Now there is no doubt that the old crude method of employing fresh urine gave good results in certain cases, but the general adoption of such a treatment would be condemned on æsthetic grounds alone. The soundness of this treatment has been proved by recent investigations. It has been found that the optimum strength of a solution of the pure urea is one of from 2 per cent. to 5 per cent. It is a significant fact that the concentration of urea in fresh human urine is approximately 2 per cent. Solutions of up to 20 per cent. have been used without giving rise to untoward result.

Urea was the first organic substance to be synthesised in the laboratory. This was done by Wöhler over a century ago[1]. It is now manufactured on a large scale, being used as a soil fertiliser. It is a pure white crystalline substance and as such it is free from any of the objections which are associated with the use of animal excretion.

It is non-toxic, in fact it can be found in plants and all tissues. It is very soluble in water and concentration may be as high as 40 per cent. Sterile distilled water should be used to prepare the solutions. Temperature should be kept relatively low for at above body heat chemical changes occur. It also breaks down in the presence of bacteria. The latter fact is marked in some cases of infection of the urinary system for the urea present is broken down, ammonia is liberated and can be identified by its smell in the urine. Urea has a purely local effect. It acts only when in contact with the tissue and its action does not persist.

I have now used urea in a great variety of cases, including the after-treatment of 14 cases of pole evil and fistulous withers and four cases of quittor; and many suppurating and ulcerating wounds in horses and dogs.

The method of application has been by swab or spray or by the use of saturated gauze or cotton wool dressings. Dressings can be applied several times daily if necessary.

As a result of this experience I can fully substantiate Robinson's views that solutions of urea are an excellent dressing for suppurating wounds in that pyogenic infection is noticeably reduced, necrotic material comes away readily and the production of healthy granulation tissue is stimulated and healing is hastened. I have not observed that it has any marked anæsthetic effect.

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[1] Wöhler, F.: "Sur la Formation Artificielle de l'Urée," *Am. d. Chem.*, 37, 330-354, 1828.

I am indebted to Dr. H. Hepworth, of the Imperial Chemical Industries, Ltd., for bringing this matter to my notice and also for supplying the specially purified urea which has been used in these tests.

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PULMONARY TUBERCULOSIS IN MAN AS A SOURCE OF INFECTION FOR CATTLE

By F. WOLDIKE NIELSEN and N. PLUM

From the State Veterinary Serum Laboratory and the Veterinary Directorate, Copenhagen.

As the eradication of tuberculosis in cattle is progressing it is found that the question of transmission of tuberculous infection from man to cattle plays a greater role than was assumed previously.

Formerly the question of infection from man to animals has been looked upon as rather simple, as it was thought to involve infection from persons infected with human or bovine tubercle bacilli. It now has been ascertained that the bovine type of tubercle bacillus in the human host may gradually change in properties, so that it is successively altered from possessing the properties of the bovine type to behaving like the human type; the question can no longer be considered so simple as mentioned above. After this there will be a chance also of a third possibility, namely, that we may meet with infection from persons who excrete tubercle bacilli of a form intermediate between the bovine and the human type.

This circumstance may probably give us the explanation why occasionally we meet with infections in cattle from human beings in which the tuberculin reactions and the infection of the respective animals appear to be less clear-cut than in previously known infections with either type of tubercle bacilli—bovine or human—and where the whole picture of the infection may be explained more easily and readily by attributing it to such an intermediate form of the tubercle bacillus as just mentioned. Furthermore, the occurrence of such intermediate forms as a source of tuberculous infection in cattle may also explain very well the peculiar variable course which the so-called human infections may take in cattle, for here we may see that the reaction power of the animals subsides rapidly, while in other cases we find the reaction power persisting through a considerable length of time.

In our work of combating tuberculosis among cattle in Denmark we have lately encountered, at any rate one case, what may possibly be explained by the circumstances that the infection is produced by tubercle bacilli of intermediate virulence. As this case has not yet been cleared up fully, however, in the following we shall limit ourselves to the two kinds of infection from man to cattle that have been known and described previously, namely: (1) infection of cattle from man with tubercle bacilli of the human type, and (2) infection of cattle from man with tubercle bacilli of the bovine type.

(1) Infection of cattle with tubercle bacilli of the human type has been

described previously, particularly by Scandinavian authors. In 1936, N. Plum[1] gave a survey of the cases described up to that date, and reported a few experiments of this kind carried out in the field. Plum further described an experiment in which healthy cattle were fed sputum from tuberculous patients mixed in the feed. These studies confirmed the observations reported previously, that the tuberculin reactions in such cases are not always small, and that on repetition of the test with avian and bovine tuberculins the differentiation is often less conspicuous than in infections with bovine tubercle bacilli—in this sense, that the differentiation gives a smaller reaction in favour of the bovine tuberculin—just like tests with bovine and human tuberculins often give a greater reaction in favour of the latter. On application of the subcutaneous test, moreover, we find a very great disagreement between the results of this test and of the intracutaneous test, as only a relatively small number of intracutaneous reactors will give a positive subcutaneous reaction, while a few animals which do not react to the intracutaneous test will react on the subcutaneous test. Finally, Plum was able to confirm the well-known clinical observation that animals with this kind of infection present macroscopical lesions but relatively seldom, and in every case where such lesions were demonstrated they were only of small size.

Since the publication of the aforementioned report there has appeared only one paper on this kind of infection.

Thus Geoffrey B. Brook,[2] describing the state of tuberculosis among cattle in Canada, mentions that Watson has told him he has been able to demonstrate an instance of tuberculosis of the human type in a retropharyngeal lymph gland from a cow.

Even though in recent years we now and then have met with reactions in sound herds where the character of the reactions and other available data were suggestive of infection with human tubercle bacilli, these cases are very few as compared with the total number of sound herds in this country; besides, as a rule, such abnormal reactions were seen only in relatively few animals in each of the herds concerned. A few herds in which the number of such infected animals is relatively great are under observation at present.

In one instance, however, we have been able to demonstrate the presence of macroscopic lesions in an animal with tuberculous infection of human type. This happened in a herd that had always been reaction-free. The history of this case is briefly as follows:

In autumn, 1937, a positive tuberculin reaction was obtained in two cows, two heifers and one calf belonging to this herd. On repetition of the test the animals reacted to bovine tuberculin. As the veterinary surgeon thought that the two tuberculins might possibly have been exchanged by mistake, the test was repeated again later on, without giving any definite result in either direction. Four months after the last test the animals were tested anew, but at that time one of the cows had been sold, and one of the heifers and the calf

did not react, so that the only reacting animals now were one cow and one heifer. The cow was sold alive. The heifer was killed and in its mesentery the veterinary surgeon found a caseated and calcified nodule (about the size of a pea) in which tubercle bacilli could not be demonstrated on microscopic examination.

Dr. H. Bentsen, Slagelse, who sent us the organs for examination, stated that the owner of this herd had previously employed a farm hand who was now staying in a tuberculosis sanatorium for the second time. We succeeded in tracing him and obtaining a specimen of his sputum for type determination. Microscopic examination of the sputum failed to reveal the presence of tubercle bacilli, but cultures from the sputum as well as from the lesion in the mesenteric lymph gland showed growth of tubercle bacilli of the human type, and the same type was obtained on inoculation of guinea-pigs with the sputum and lymph gland.

Naturally, we think, this case is to be regarded merely as a minor episode in the combating of tuberculosis, but here we were able to demonstrate a macroscopic lesion in a mesenteric lymph gland, and as the case may be considered a very illustrative paradigm of a great number of small infections, we have found it appropriate to give this detailed description of it.

(2) While the question of infection from man with tubercle bacilli of the human type has been studied for several years (after it was set up originally in Finland), the question of infection of cattle from man with tubercle bacilli of the bovine type is of a relatively recent date.

Various authors have demonstrated that the bovine type of the tubercle bacillus plays a considerable role in the occurrence of tuberculosis—especially pulmonary tuberculosis—in man. N. Plum[3] in 1935 carried out some experiments in order to show whether such bovine bacilli which had had at least one passage through man were still virulent for cattle. And the experiment proved this to be the case.

From this it seemed reasonable to expect that it might be possible to demonstrate some cases in which healthy herds were infected by persons with open pulmonary tuberculosis due to bacilli of the bovine type. At a meeting of the Scanian Veterinary Society in December, 1936, Plum reported his experiments, and stated at the same time that he had not yet been able to prove the probability of this way of infection in practice. In the following discussion at this meeting, A. Lindau, E. Hedvall and, especially, H. Magnusson[4] reported an instance where a female milker, who died shortly afterwards of bovine tuberculosis, had infected 49 head of cattle belonging to a herd of 74 animals. The infection involved in particular the adult cows, as 33 out of 37 gave a positive reaction.

Apart from this communication, as far as we know, no report has been published on demonstrations of such infections.

For more than two years now we have been paying particular attention

to this method of infection when we have learned of new infections occurring, especially in districts that have already been rid of tuberculosis in cattle. In many instances, however, it has been impossible for us to probe the matter to the bottom, as a thorough examination of the respective farms as a rule involves such great difficulties of a purely practical nature that we have given up trying to carry the investigation through by force. Often the chief difficulty lies in the circumstance that the farm hands are afraid to submit to a medical examination, while the owner (and the local physician too, if his advice is asked) has not been entitled to carry through the examination without the personal permission of the employees. Another difficulty lies in the fact that the owners of the herds are often afraid to put any great pressure on their employees, fearing that their helpers might quit on this account and leave them without the workers required for the management of the farm. In several instances, thus, where it seemed very likely that the new infection had been transmitted to the cattle from man we had to give up any medical examination of the hands working on the farm.

TABLE 1

Survey of Herds Infected with Bovine Tubercle Bacilli by Transmission from Man to Cattle

Case No.	Location of the farm District (Town)	Number of animals in the herd	Number of reactors in the herd
1	Funen (Hesselager)	29	19
2	Jutland (Grindsted)	45	16
3	Taasinge	28	25
4	„	35	17
5	Jutland (Stakroge)	16	11
6	Fanø	17	7
7	Zealand (Holbæk)	33	22
8	„ „	27	16
9	North Funen	32	32
10	Falster	65	57
11	Zealand (Ringsted)	30	21
12	Jutland (Gadbjerg)	29	6
13	Funen (Faaborg)	52	43
14	Zealand (Korsør)	5	5
15	„ (Skælskør)	19	13
16	„ (Slagslunde)	20	17
17	Jutland (Fredericia)	150	70
	Total	632	397

Lately, however, we have been able in several instances to demonstrate this method of infection; we have tried to press such cases more forcibly than

before. And these efforts appear to give good results. We are not far from venturing to claim that whenever a relatively large number of new infections are demonstrated in a herd within a tuberculosis-free dairy district, it is very likely that the infection originates from a person. Probably such an assertion will be regarded in general as an exaggeration, yet it is based on the experiences we have had. For it has turned out that we have been able to demonstrate the source of infection in the personnel of the farm in a good many of the cases where we were enabled to investigate the matter more thoroughly—either by obtaining suitable specimens of sputum from the entire personnel of the farm, or by watching the personnel for some length of time.

In Table 1 a survey is given of the cases, encountered in the last 2½ years, in which we have been able to demonstrate transmission of infection of bovine tubercle bacilli from man to cattle. As will be noticed, in these 17 cases a total of 397 out of 632 animals were infected in this way. Naturally, the relative frequency of the infection in the individual herds has been somewhat variable. As the history of some of these cases is quite interesting, it will be appropriate here to give certain particular data as far as we have been able to obtain them.

Case 1.—This herd had proved to be sound ever since the first test, which was performed in 1932. Now, 19 out of 29 animals suddenly gave a positive tuberculin reaction, and yet no infection from other cattle could be demonstrated. Suspicion pointed toward the attendant as the source of infection in this case, and he was ill at that time. The owner of the herd stated that the attendant previously had been vigorous and apparently healthy, but then he had become ill and was admitted to a hospital, from which he had been transferred to a tuberculosis sanatorium. From this sanatorium we learned that he was suffering from extensive pulmonary tuberculosis, besides a cold abscess of one foot. When we were informed that no type determination of the infecting tubercle bacillus in his case had been made we obtained a specimen of sputum from him as well as pus from the cold abscess. Tubercle bacilli of the bovine type were demonstrated in both specimens. As the growth in the cultures from the two specimens was somewhat deviating from the normal, reminding rather of the growth of human tubercle bacilli, we discussed this subject with Dr. K. A. Jensen, Chief of the Tuberculosis Department of the State Serum Institute. In this way it was found that the tuberculosis of this man had been type-determined previously in the Serum Institute, where the culture was still preserved. This two-year-old culture still proved capable of growth and behaved quite like a normal bovine culture. Even though this case was not followed further it still indicates that at the time when we had occasion to examine the patient—about four months after he had quit his job on the farm—the infecting bovine tubercle bacilli in his case had a distinct tendency to approach the human type.

Case 2 took place in the vicinity of Grindsted, Jutland. We have not had

any occasion to follow this case ourselves, but the data furnished us—that a new infection was ascertained in the herd shortly after a new attendant had taken charge of it and that this man a little later was sent to hospital for tuberculosis, which disease was then type-determined as produced by bovine tubercle bacilli—suggests decisively indeed that the infection was transmitted from the attendant.

Cases 3 *and* 4.—In both of these instances the infection was transmitted from the same man who was tending the cattle on the two farms. The district was free from tuberculosis, so the veterinary surgeon naturally was surprised when reactors suddenly turned up in the first of these herds, in which the tuberculosis was typed as due to bovine bacilli. When new reactors were found in the other herd too, on the farm where the attendant lived, the veterinary surgeon suspected him as the source of the infection. After some preliminary difficulties we succeeded in obtaining a specimen of sputum from him; it was found to contain tubercle bacilli that were typed in the State Serum Laboratory as well as in the State Serum Institute, and found to be of the bovine type.

Case 5.—In this instance it was the owner who conveyed the infection to his tuberculosis-free herd. The owner entered a tuberculosis sanatorium, but we had a great deal of difficulty in obtaining any sputum from him, as he and his family were very reluctant to have it established that he had transmitted the infection to his stock. Typing of the tubercle bacilli demonstrated in his sputum showed, however, that he was suffering from pulmonary tuberculosis due to bovine bacilli.

Case 6.—In this case the source of infection was a young girl who had become ill and went home to her parents, on the island of Fanø, which at that time had been rid of tuberculosis in cattle. Although she did no work in the barn, she still infected seven out of the 17 cows, as her excretions and expectorate were dumped in the stable, so that the infection most likely was transmitted to the cattle in this way.

Cases 7 and 8.—In these two instances, too, the herds were infected by the same person, a farm hand, who worked first on farm seven. After he had left farm seven, reactors began to turn up in the herd. When the owner of farm eight, where the man now was employed, heard about the reactors on farm seven, and noticed that the man was coughing a good deal, he asked him if it might perhaps be he who was infecting the animals. But the farm hand was feeling perfectly well. Nevertheless, his employer sent him to the local physician; but the doctor did not find any sign of tuberculosis in the man. Later on the man had a lesion of his elbow joint, and he was referred to the surgical department of the county hospital, where it was found that, besides the joint lesion, one of his lungs was the site of a large tuberculous cavity. When we were informed about this turn of the matter we applied to the hospital, and received a specimen of his sputum. On typing of this specimen

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it was found that the tuberculosis in this man was due to the bovine type tubercle bacilli.

Case 9 took place on a model farm where all the 32 head of the herd suddenly turned out to be positive reactors. The veterinary directorate was asked to investigate the conditions on this farm, and when we visited the farm there was nothing with which we could find fault. This almost left the one possibility, that the infection might originate from the personnel, but all the persons on the farm looked perfectly sound and healthy. We insisted, however, on obtaining a specimen of sputum from everybody—five persons altogether—who had anything to do with the cows, and in one of these sputa we were able by cultivation and inoculation to demonstrate bovine tubercle bacilli. The infected man stated that about a year ago he had worked on a farm that furnished a neighbouring town with certified milk, and where the personnel on that account had to submit to a physical examination by a physician. He had complied with this, and got a clean bill of health. After leaving that farm he had worked on another farm where the herd had been tuberculous through and through, and he felt convinced that he had acquired the infection there. Although he now was feeling quite well, and the diagnosis of open tuberculosis was most surprising to all who knew him, the X-ray examination revealed such great changes in his lungs that he was admitted to a sanatorium at once.

Case 10 involved a farm that was located in a tuberculosis-free district. On tuberculin tests a great many reactors were disclosed in this herd, and as the reactions generally were rather small, the incidence suggested the possibility of infection with tubercle bacilli of the human type. After further tests, however, there could be no doubt that this case involved infection with the bovine type; in addition, extensive tuberculosis was demonstrated in several slaughtered hogs from this farm. In order to verify this view, a calf was killed, and it showed tuberculous infection of peribronchial and mesenteric lymph glands. On our examination of the farm we were not able to demonstrate any source of infection. The farm hand claimed to be well and he did not appear to be ailing. So at that time we were not able to push the matter further. We asked the local veterinary surgeon to keep us posted, however, about anything of interest that might turn up in this matter. About one month after our visit to the farm we were notified that the farm hand had had a hæmorrhage from the lung, and was admitted to the local hospital. On application to this hospital we received a specimen of sputum from this man, and the type determination showed he was infected with the bovine type of tubercle bacilli.

After this demonstration of the source of infection the entire herd was tested again, with the result that now there were altogether 56 reactors among the total 65 head of this herd. Fifty-four reactors were killed, and tuberculous lesions were found in the lungs or appertaining lymph glands in 21 animals;

besides, tuberculosis was demonstrated in the lymph glands of the digestive tract (mesenteric and retropharyngeal lymph glands) in 13 animals, whereas no tuberculous lesion was found in 20 of the reactors.

Case 11 also involved a previously sound herd, in which 19 of the 30 animals suddenly turned positive reactors, and subsequently two additional animals gave a positive reaction. The previous owner of this farm who now had surrendered the farm to his son, but kept on living here, was suspected of being the source of infection, and examination of his sputum in the State Serum Institute proved indeed that he was infected with bovine tubercle bacilli. All the reacting animals were killed, and tuberculous lesions were found in 20 of them, while no tuberculosis was observed in one animal. Of the 20 animals, four showed tuberculous lesions in the lymph glands of the digestive tract, while 17 showed tuberculous lesions in the lymph glands of the lungs—and two of these animals also presented tuberculous lesions in the lungs parenchyma.

Case 12.—This herd was free from tuberculosis in 1936. In 1937 a tuberculin test was performed in which six of the 29 animals of the herd gave a positive reaction. At the time when this test was performed the daughter of the farmer was admitted to a sanatorium, suffering from pulmonary tuberculosis. At our suggestion, a type determination was made of her sputum, and it showed that the tubercle bacilli present in the sputum were of the bovine type. Before her admission to the sanatorium this young woman had been tending the cows, and in the performance of this work she had conveyed the tuberculous infection to them.

Case 13.—In a highly yielding herd at Faaborg a tuberculin test in February showed 43 reactors among the total 52 head of the herd. One of the reactors was killed, and in the meat inspection a tuberculous lesion (size of a pigeon egg) was found in a bronchial lymph gland. In this case no type determination was performed because the Veterinary Directorate learned of this case only in a roundabout way a couple of months after the performance of the test, and at that time the reactors had all been sold. It can merely be stated that the reaction values in the first test, as well as in the second and the autopsy findings in the killed animal, were positively suggestive of bovine infection.

A young man who had been tending the cattle on that farm from May, 1938, to January, 1939, was suspected of being the source of infection in this case. He was said to have tended the animals well, although not infrequently he had to keep to his bed for a couple of days, and that he often had a coughing spell. He had left the farm in January, but he was traced and found in an agricultural college. X-ray examination revealed a rather large cavity in one of his lungs. Microscopic examination of his sputum showed the presence of tubercle bacilli, which on cultivation showed growth of the bovine type. In his case the pulmonary tuberculosis was diagnosed on one of the last days in

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April, and thus a very fine herd avoided meeting the same fate as was suffered by the aforementioned—for the young man had already been engaged as an attendant for the new herd and was to enter this service on May 1.

Case 14 involves a little herd of five, near Korsør, that were bought from tuberculosis-free stocks in September, 1937. One month after their arrival at this farm all the animals passed a tuberculin test. In February this year all the animals gave a positive reaction. The owner of the herd was suffering from pulmonary tuberculosis, and tubercle bacilli of the bovine type were demonstrated in his sputum. Perhaps this case has to be taken with some reservation, as the possibility cannot be excluded, that one of the animals may have become infected in the transport without being able to give a positive reaction on the test performed one month after its arrival to the farm.

Case 15.—A herd in Tystofte, near Skælskør, had been free from reactors for a good many years. On a tuberculin test, in the beginning of May, 13 of the 19 animals of this herd gave a positive reaction. One of the reactors was killed, and tuberculosis was demonstrated in the posterior mediastinal lymph gland.

A hired hand on this farm was found to be suffering from pulmonary tuberculosis, and microscopic examination showed numerous tubercle bacilli in his sputum. The type determination has not been completed yet, but judging from the appearance of the culture so far there can hardly be any doubt that this farm hand is infected with the human type of the tubercle bacillus.

Case 16.—In a herd in Slagslunde a tuberculin test, performed in January this year, showed 17 reactors among the total 20 head of the herd, which previously had been free from tuberculosis. As suspicion pointed to no particular person on this farm as a source of infection, a specimen of sputum was obtained from everybody who had anything to do in the cow stable. After repeated examination of several sputa the suspicion pointed to a certain young man who worked on the farm, but tubercle bacilli were exceedingly scarce in his sputum. This farm hand was referred therefore to a specialist in diseases of the lungs, Dr. Johannes Holm, the Tuberculosis Station of Copenhagen, who examined him, and ascertained rœntgenographically the presence of a cavity in one lung. The type determination of the infection has not been completed yet, as the isolated strain of tubercle bacilli at first showed some peculiar features of growth.

All the reacting animals in this herd were killed. In one animal the autopsy revealed no abnormality; the others presented rather fresh tuberculous lesions in the bronchial lymph glands; two animals showed also lesions in the lung tissue. Besides the cattle herd on this farm, the swine herd also was infected with tuberculosis. Up to the date of this writing, ten swine have been killed, and five of these were condemned on account of tuberculosis; two swine have died "spontaneously"; one of these was examined post-mortem by the veterinary surgeon, who gave tuberculosis as the cause of death.

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This herd had been free from reacting animals for the last ten years. The farm hand concerned in this case—20 years old—had been employed on October 1, 1938. So attention is here to be called to the relatively short interval between his arrival at the farm and the thoroughly accomplished infection of the herd. It is to be mentioned too that this young man had been feeling perfectly well in every respect, having no idea whatever about his lung lesion.

Case 17.—On a farm near Fridericia, in Jutland, the herd passed for the third time the tuberculin test performed in April, 1938. One year later the test was repeated on the herd, comprising about 150 head, and now 26 animals gave a positive reaction. Except in one cow, the reactions were on the whole rather small. Yet, on repetition of the test, all the animals reacted more strongly to bovine tuberculin. In a subcutaneous test on the reactors only 12 of the 26 animals showed a distinct reaction.

As no certain person was suspected to be the source of infection, specimens of sputum were obtained from all who had anything to do in the cow stables. The sputum of a milkmaid was found to be thick with tubercle bacilli which in cultures gave growth of the bovine type. Unfortunately, this maid was occupied not only with milking, but also with other work. For instance, while the assistant was sick and confined to bed, this maid swept all the cribs. Under these circumstances it was to be expected that additional reactors would turn up later on—and they did. A tuberculin test performed in June showed 44 additional reactors, making a total of 70 infected animals in this herd. Sixty-two calves and heifers on pasture have not been tested yet. So it may be we have not got to the end yet.

The milkmaid left the farm on May 1, and was admitted to a sanatorium. On April 27 six cows were bought from tuberculosis-free stocks. On the test in June, three of these six cows gave a positive reaction—that is, they had been infected within the period of April 27-30. One of these cows was killed on June 23—about two months after its purchase—and the autopsy revealed a quite fresh tuberculous lesion (size of a hazel-nut) in the right lung and some very large mediastinal lymph glands with caseation. Three other cows were killed at the same time, and they all showed quite recent tuberculous lesions in the bronchial lymph glands.

The milk from this herd was distributed raw in a town nearby—under the designation " school milk." It was distributed in particular to the public schools, while a smaller part of it was sold to households.

Comments

It has to be admitted that the number of cases in which we have been able to ascertain that cattle have been infected with bovine tubercle bacilli from persons with pulmonary tuberculosis is not strikingly great. Even if we reckon also the cases in which it has been reasonable to assume that the herd

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was infected in this way, their number will only be very small as compared to the thousands of tuberculosis-free herds that are now under systematic control by means of tuberculin tests.

Yet there can be no doubt that cases like those here described imply a problem that naturally has to be solved if we are going to carry through our fight against tuberculosis successfully. Too many recurrences of this kind in tuberculosis-free herds within districts that have once been rid of tuberculosis will not only mean considerable financial losses to the owners of the herds concerned, who are not to be blamed for the infection of their herds, but also contribute to maintain the criticism advanced by the opponents of the campaign that now is being waged against tuberculosis in cattle; besides, they will prevent a complete accomplishment of this great task.

Probably some readers will think that this matter is rather simple. In such cases, they will say, where conditions may suggest the possibility that some person may be the source of infection, all we have to do is to ask the person in question—or, if needs be, everybody on the farm—to furnish a specimen of sputum. Nevertheless, this simple preliminary request will often present so many difficulties and create so much animosity, more or less evident, that a thorough investigation may meet insurmountable hindrance. At present the farmers have a hard time getting sufficient hired help, so that the owners of the herds naturally will be a little uneasy about insisting upon a medical examination of their employees, fearing that they might prefer to leave the job rather than submit to the examination. Besides, in spite of all the education that has been carried out to teach the public that early medical treatment is of fundamental importance, there are still a good many people who refuse to be examined because they are afraid about the possibility that it might prove they are consumptive.

In cases where the owner or some member of his family turns out to be the source of infection we meet other difficulties. On a small farm, for instance, it will not be practicable to keep the farmer or his wife from taking a part in the care of the animals. Finally, as happened in a couple of the cases mentioned above, difficulties may arise with regard to financial aid for the farmer in ridding his herd of tuberculosis. When, for instance, a dairy district through public aid has become free from tuberculosis, and some years later a herd within this district becomes infected, say, from a hired attendant who happens unknowingly to be suffering from pulmonary tuberculosis, a question of compensation arises that may cause a great deal of discord and enmity among the farmers furnishing milk to the co-operative dairy. For public aid is not available for continued eradication of tuberculous cows in the dairy district, and perhaps the by-laws of the dairy do not include statutes providing that the owner is compelled to get rid of his tuberculous animals at his own cost, or that the dairy co-operation compensates him for his loss.

Thus it may be necessary for measures to be adopted not only for the

elucidation of cases such as those here described, but also for their prevention, limiting the above-mentioned difficulties to the least possible.

In the first place, legal measures ought to be adopted that will make it possible to enforce medical examination of all persons that may come into consideration in connection with the appearance of new infections in hitherto tuberculosis-free herds when the Veterinary Directorate finds such examination to be indicated. This examination ought to be very thorough, including examination of one or more specimens of sputum by direct microscopy and also by cultivation and inoculation. Hence the examination ought to be carried out in tuberculosis stations, at the expense of the public.

In this field, moreover, efforts ought to be made to establish co-operation between physicians and veterinarians, aimed primarily at a singling-out of the patients who are suffering from an open pulmonary tuberculosis due to the bovine type of the tubercle bacillus. The ideal would be that every tuberculosis patient seeking medical advice, admitted to a sanatorium or meeting for control at a tuberculosis station would be examined with a view to establishment of the type of tubercle bacillus involved in his case. As at present such a scheme will probably be impracticable, however, veterinarians have to emphasise that it is desirable that at any rate all tuberculosis patients working on farms with cattle and swine herds submit to type determination of their sputum. Then the laboratory where this typing is done ought to notify the Veterinary Directorate about the patients who are found to be infected with the bovine type. It may be added that such an arrangement has been tried out with good results in one place here in this country—namely, by co-operation between the Spangsbjerg Sanatorium and the district veterinarian, Dr. S. Bjerregaard, Grindsted.

The Veterinary Directorate will then be able to keep a card index of these patients, so that when new infections turn up in previously tuberculosis-free herds it will be possible at once to make sure whether any of the persons living on the farm in question has been found previously to be infected with the bovine type of tubercle bacilli. Further, every one of these patients ought to be instructed by his physicians, the sanatorium or the tuberculosis station that he is very likely to transmit the infection to the cattle and swine herds if he engages in taking care of or tending such animals. Of course, the patients who recover from this lesion ought to be advised explicitly to seek medical advice at once if any of their old symptoms turn up again.

Summary

Infection from man with the human type of tubercle bacilli is mentioned in general, and a more detailed mention is made of one case in which a tuberculous process in a mesenteric lymph gland was produced by this type.

A brief description is given of the course of 17 cases in which sound cattle have been infected from persons with open pulmonary tuberculosis due

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to the bovine type. These 17 herds comprised altogether 632 head of cattle, and 384 of these animals gave a positive tuberculin reaction.

Mention is made of the difficulties in effecting the proper examination of the suspected personnel of the infected farms, and it is suggested that legal measures be enacted to provide for medical examination of such suspected persons on the recommendation of the Veterinary Directorate.

A more close co-operation between physicians and veterinarians in such cases would be highly desirable. Therefore it is suggested that all tuberculous persons taking part in the care of cattle have their infection type-determined under Government authority, and that the Veterinary Directorate be notified at once of every case in which infection with the bovine type is demonstrated.

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INVESTIGATIONS ON THE SEMEN OF FERTILE AND STERILE BULLS (Continued)

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Particulars of the volume of the ejaculate in different breeds is given in Tables 5 and 6. It is evident that there is some variation in the mean volume of the ejaculate in the different breeds of pure-breds and in grade bulls.

Density.—Owing to the breaking of the only hæmocytometer slide available spermatozoa counts are available for only six bulls. The mean number of spermatozoa per c.mm. was 873,000±8,000 (standard deviation, 35,300; range, 510,000 to 1,875,000). These data refer to fertile bulls. In addition, however, ejacula were classified as "D," "M" or "R," as mentioned previously. Of 456 ejacula obtained from bulls in Group 1, 246 (53.9 per cent.) were regarded as "D," 205 (44.9 per cent.) as "M" and 5 (2.2 per cent.) as "R."

Ejacula were collected from some of the bulls over a period of two years at fairly frequent intervals, and only in the case of one bull, a Shorthorn grade, in September, 1937, was the ejaculate of lesser density than

normal. Occasionally some bulls, though they have a proper thrust on the first jump, produce a less dense ejaculate than on subsequent jumps.

VOLUME OF EJACULA IN DIFFERENT TYPES OF BULLS

TABLE 5

Adult Bulls Type	*No. of Bulls*	*No. of Ejacula*	*Volume in ml. Mean*	*Standard Deviation*	*Range*
Ayrshire	8	51	5.06±0.30	2.1	1.7—10.0
Ayrshire grade	1	25	6.77±0.37	1.3	4.0—12.0
Aberdeen Angus	2	19	5.45±0.33	1.3	4.0— 8.0
Friesian	34	93	5.88±0.37	2.6	1.0—12.0
Shorthorn grade	6	76	5.94±0.17	1.5	3.0— 8.5
Sussex	2	28	4.37±0.25	1.3	1.0— 6.4
Mixed types	8	12	4.75	—	—

TABLE 6

Young Bulls Type	*No. of Bulls*	*No. of Ejacula*	*Volume in ml. Mean*	*Standard Deviation*	*Range*
Ayrshire	9	18	3.65±0.33	1.3	2.2— 6.0
Friesian	11	56	4.61±0.25	1.9	1.7— 9.0
Mixed types	5	16	3.3	—	—

Fifty-two bulls with epididymitis were capable of service; forty of these bulls ejaculated no spermatozoa, five produced dead spermatozoa and seven spermatozoa which showed feeble activity. Sperm tests were made on five bulls during the development of this condition. Bull No. 232 in January, 1937, had no clinical abnormalities in either testes or epididymes, and he produced a watery ejaculum containing no spermatozoa. Bull No. 225 in January, 1937, also had no abnormalities in testes or epididymes, and his spermatozoa concentration was of medium density. In July, 1937, his ejaculum was watery and spermatozoa rare, and the tail of the right epididymis was enlarged and indurated. Bull No. 119 in December, 1936, had a slight enlargement of the tail of the right epididymis; his ejaculation contained no spermatozoa. In March, 1937, this bull had both tails of both epididymes enlarged to the size of a golf ball and indurated; his ejacula contained no spermatozoa. Bull No. 109 in April, 1937, had an enlarged and indurated tail of the right epididymis. His ejaculation contained dead spermatozoa. In August he ejaculated spermatozoa of medium density but of very feeble activity.

Bull No. 111 is the most interesting case, since he was under observation for fourteen months and it was not until the end of that period that he showed signs of epididymitis. In June, 1936, he produced an ejaculum with medium concentration of spermatozoa. At this time his penis bled when

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serving. In seven other tests during this month the spermatozoa concentration varied from medium to very rare. In January, 1937, he ejaculated a dense specimen of sperm and in March and April he produced sperm of medium density. In August he showed definite signs of epididymitis, but was unable to serve owing to swelling of penis.

Of five bulls whose testes were either enlarged or abnormally small, two produced no spermatozoa and the other three sperm of medium to rare density. Of fourteen other bulls which showed no clinical abnormalities in the testes or epididymes, eight produced sperm of medium density and the others no spermatozoa.

Spermatozoa were thus absent in the majority of cases of epididymitis, in some of the cases of testicular abnormalities and in some cases which showed no clinical abnormalities in the testes or epididymes. On the other hand, the concentration of spermatozoa may be of medium density in sterile bulls.

DENSITY AND MOTILITY OF EJACULA

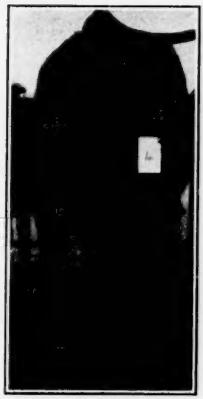
TABLE 7

	Total No. of Ejacula	*% of Ejacula of Density*				*% of Ejacula of Motility*					
		D	*M*	*R*	*A*	*vva*10	*vva*9	*vva*8	*vva*7	*vva*7	*Nil*
Group 1 ...	456	53.9	44.9	2.2	—	46.9	35.7	10.4	4.2	2.7	0.2
Group 2 ...	60	2.0	46.1	51.9	—	13.5	15.4	7.6	13.5	50.0	—
Group 3											
Epididymitis	124	0.9	6.4	10.5	82.2	—	—	—	—	54.5	45.5

Motility.—The motility of the sperm specimens for the different groups of bulls is shown in Table 7. A small number of ejacula from Group 1 bulls showed either no motility or poor motility. Of seven bulls which ejaculated spermatozoa of poor motility, three were young bulls and the others were adult bulls in regular but not excessive work. Bull No. 4 is of particular interest, since apart from two ejaculations of poor motility in September, 1937, he produced very good ejacula for over two years. Bull No. 5 on September 8, 1937, produced an ejaculate containing no spermatozoa. This bull was a young bull in poor condition, and had only two previous services in September on the 2nd and 4th, when his sperm was very actively motile. Bull No. 89 produced very actively motile sperm in April, 1937, but in August his sperm was dead. This bull was affected in one leg by a necrotic form of foot rot which extended to the fetlock.

While a few ejacula from bulls in Group 2 showed good motility (vva7 to vva10), the majority were of lower motility. Of the 52 bulls with epididymitis, five produced dead spermatozoa and seven sperm of poor motility. It was noted that spermatozoa often ceased to be ejaculated before clinical signs of this condition were evident (Bulls Nos. 120 and 252). Bull No. 109 in February, 1937, showed a slight enlargement but not induration of the tail of the right epididymis; in April induration had occurred. In April

No. 1



No. 2

No. 3

No. 4

No. 5

No. 6

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this bull produced only a few dead spermatozoa. Bull No. 225 had normal testes and epididymes in January, 1937, but in July of that year the tail of the left epididymis was enlarged and indurated. In January he ejaculated very actively motile spermatozoa (vva10), but in July the activity was much less (va5). The presence of blood in the ejaculate appears to lessen the motility, e.g., Bull No. 111, which bled from the penis on serving, produced sperm of poor motility (va6). Three bulls with abnormally large or small testes as well as eight other bulls with no detectable abnormalities in the testes and epididymes produced spermatozoa of poor motility (oscillatory or active).

Over-use of a bull also appears to reduce the motility of his spermatozoa, e.g., Bull No. 106, a young bull, was used rather often owing to a shortage of bulls. At first the motility of his ejaculations was very good, but after being used for a time the motility became very much poorer. A few days' rest, however, was sufficient to restore the motility to normal.

Abnormal and Immature Spermatozoa.—In Tables 8 and 9 particulars of abnormal and immature spermatozoa in the ejaculates of bulls in the three groups are shown.

SUMMARY OF ABNORMAL AND IMMATURE SPERMATOZOA

TABLE 8

	No. of Bulls	*No. of Sperm Specimens*	*% of Abnormal Spermatozoa*	*% of Immature Spermatozoa*
Group 1	54	68	8.1	0.4
Group 2	15	16	13.1	0.6
Group 3—				
(a) epididymitis ...	11	12	17.6	6.2
(b) testicular abnormality	2	2	15.5	0.0
(c) no clinical abnormality	3	3	10.0	0.0

In the sterile bulls observed in this investigation the percentage of abnormal spermatozoa varied. In three bulls (Nos. 145, 164 and 167—these bulls showed no clinical abnormalities) which produced ejacula in which spermatozoa were rare and of poor motility the percentage of abnormal spermatozoa was 10.0. In one bull (No. 47) with an abnormally large left testicle the percentage was 22.0, and in another bull (No. 108) with a small left testicle the percentage of abnormal spermatozoa was 9.0. In eleven bulls with epididymitis the percentage of abnormal spermatozoa varied from 4 to 66.

The percentage of immature spermatozoa was small in all groups. Such spermatozoa were not found more particularly in younger than in older bulls. The percentage of spermatozoa with protoplasmic drops at the end of

the middle piece in bulls in Groups 1, 2 and 3 was 1.7, 0.6 and 0.2 per cent. respectively.

Discussion

The most common cause of sterility in the bulls examined was chronic enlargement and induration of the epididymis. This was clinically recognisable in 31 per cent. of the bulls. The condition has been known to exist in Kenya for a number of years, and its incidence was probably much greater than was suspected. Its occurrence in other countries must be exceedingly rare, for a fairly thorough search of the literature has revealed only two references to a similar condition. These were described by Williams, W. L. (1923), and the illustration of the epididymis of one of these bulls presents a similar picture to that found in bulls referred to in this paper as having enlargement and induration of the epididymis.

ABNORMAL AND IMMATURE SPERMATOZOA

TABLE 9

Group 1.—No. of Bulls = 55.

Type	1	2	3	4	5	6	7	8	9	10	11
Mean	1.0	2.3	55.0	0	0.5	3.0	18.8	80.6	8.06	4.3	16.7
Range	0-10	0-36	0-160	0	0-2	0-30	0-110	14-180	1.6-18	0-77	0-300
Group 2.—No. of Bulls = 15.											
Mean	8.1	2.7	87.4	0	2.1	5.6	30.0	135.9	13.5	0	5.6
Range	0-60	0-20	0-300	0	0-1	0-28	0-227	15-286	1.5-31.0	0	0-60
Bulls with Epididymitis = 11.											
Mean	3.5	0.6	146.5	0	0	2.5	22.4	175.5	17.5	6.1	2.0
Range	0-30	0-8	20-480	0	0	0-20	0-180	20-660	2-66.0	0-74	0-14

All counts are given per 1,000 spermatozoa except for "9," which is a percentage.

CLASSIFICATION OF ABNORMAL AND IMMATURE SPERMATOZOA

1. Large heads.
2. Small heads.
3. Abnormally shaped heads.
4. Impaired staining capacity.
5. Abaxial fastening of middle piece.
6. Loose heads.
7. Other abnormalities.
8. Total count of abnormal spermatozoa per 1,000.
9. Percentage of abnormal spermatozoa.
10. Protoplasmic drop on neck (immature spermatozoa).
11. Protoplasmic drop at end of middle piece.

Williams investigated a herd of over 150 cows with a poor breeding record. One bull served a number of heifers without pregnancy occurring, and an examination revealed that his testes, epididymes and seminal vesicles were hopelessly infected and gross changes had occurred. This bull ejaculated no semen. Four other bulls in this herd were slaughtered on account of genital disease (no clinical data given). The breeding records showed that there was a high incidence of abortion following service by these bulls, which is suggestive of trichomonad infection. It is not clear if these bulls were also affected by epididymitis. Cows bred to one of these bulls during the

later part of his career quite uniformly showed virulent vaginitis within a few weeks after copulation, and later examination commonly revealed severe cervicitis. The females in this herd suffered in unusual proportion and intensity from cervicitis and salpingitis. The cervicitis largely yielded to treatment, but the salpingitis was beyond remedy and a large proportion of the original herd was ultimately destroyed. Genital infection in this herd undoubtedly appears to have been spread by coitus, and it also appears to have been responsible for at least one case of epididymitis. W. L. Williams (1923) refers to two cases of epididymitis. In one bull the disease was bilateral, there being present a small chronic abscess in the globus minor of both epididymes. His sex instinct was good, he copulated freely but ejaculated no spermatozoa and was completely sterile. In another bull epididymitis was clinically recognisable on one side associated with violent inflammation of the seminal vesicle. This bull also was totally sterile and ejaculated no spermatozoa. Williams remarks that diseases of the epididymis are occasionally recognisable clinically. He states: "In severe epididymitis it is difficult or impossible to differentiate it from orchitis. Neither is the differential diagnosis of known clinical importance, because each is ordinarily beyond remedy. Localised epididymitis with chronic abscessation is clinically recognisable by palpation. In the bull so far as I have observed the disease usually involves the globus minor just at the lower extremity of the testicle. There is distinct swelling and hardness, but in the chronic type it is not painful. The abscess does not point." These cases of epididymitis described by Williams appear very similar to those found in Kenya, in that (1) the clinical picture is similar, (2) the bulls ejaculated no spermatozoa or a very poor quality of spermatozoa and were sterile, (3) the cases occurred in herds affected by vaginitis and cervicitis, (4) it is highly probable that infection is transmitted by coitus, and (5) in Kenya in infected herds occlusion of the Fallopian tubes is responsible for a certain percentage of cases of permanent sterility. In severe cases of epididymitis of the bull in Kenya there is, however, no difficulty in distinguishing them from clinical abnormalities in the testes alone, though when the epididymis is greatly enlarged and indurated there may be difficulty in determining by palpation the degree of involvement of the testis. In Kenya there is not, so far as is known, a high incidence of abortion after service by infected bulls, and no trichomonads have been found in the genital discharges of cows which failed to hold to the bulls.

A number of bulls which showed no clinical abnormalities in the testes or epididymes produced either dead spermatozoa or spermatozoa of poor motility. It is possible that these bulls were in the early stages of epididymitis, since they were used in herds in which this disease was present. Twenty-six out of 78 bulls with epididymitis, five out of ten bulls with testicular abnormalities, as well as 25 bulls which showed no clinical abnormalities in the testes or epididymes were unwilling to serve. It thus seems that these chronic

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changes in the epididymis may interfere with sex instinct, though some bulls affected by apparently long-standing epididymitis serve vigorously. This aspect of the subject is complicated by the fact that many such bulls were run with the cows and were probably suffering from over-use as well as from epididymitis. It is considered probable that over-use was the cause of unwillingness to serve in the case of the 25 bulls which showed no clinical abnormalities in the genital organs. Loss of sex desire in cases of epididymitis is probably due, quite apart from over-use, to involvement of the testes. It is known that the testes are often grossly infected in this condition. A report on the pathology of the condition will be published in conjunction with other workers in due course.

It seems essential in sperm examinations in the present state of our knowledge that judgment should be based on all the known indices and not on one index alone. It is known, for example, that an animal may ejaculate motile spermatozoa and yet not be highly fertile, due to the occurrence in the ejaculate of a large number of abnormal spermatozoa. Likewise, spermatozoa may occur in high concentration in the ejaculate, but they may be of low motility.

It has been shown that there is a slight reduction in the volume of the ejaculate in the case of bulls in Group 2 and in sterile bulls. Milovanov states that the amount of sperm ejaculated by the sire is not a decisive factor. Lagerlof, for example, noted that the volume of the ejaculate was unaltered in cases of degenerative testicular changes, although the bull was sterile. On the other hand, experiments on artificial insemination, using a small dose of sperm introduced into the vagina, have given a low degree of fertility and Milovanov therefore states that if a bull on repeated tests gives sperm which appears normal, but the quantity is less than 2 ml., it should be regarded as doubtful in respect of fertility. It would appear that the volume of the sperm is more likely to be affected in disease of the accessory genital organs than in the testes themselves, for Gunn (1936) found in the ram that the bulk of a normal ejaculum is composed of accessory secretions and that though there may be a high concentration of spermatozoa they occupy little space. In the bull also, it has been noted by the author that the spermatozoa themselves occupy a relatively small part of the total ejaculate.

Although motility is necessary for fertilisation and although a lowering of the motility is commonly accepted as being associated with reduced fertility, there is a tendency to disparage motility as a reliable criterion of fertilising capacity. It would seem that motility of spermatozoa is worthy of more attention than has been paid to it lately. A large variety of degrees of motility can be noted in sperm from different bulls examined under optimum conditions and it is not unreasonable to believe that this variation in the degree or activity is intimately connected with fertilising ability.

The percentage of abnormal spermatozoa found in the ejacula of sterile

bulls (17.6 per cent.), although higher than that found in normal bulls (8.1 per cent.), is considerably less than that found by Lagerlof. Only in four bulls (94, 109, 70 and 213) was the percentage very high. Bulls 94 and 109 were affected with epididymitis. Nos. 70 and 213 were placed in Group 2, though on the basis of Williams' and Lagerlof's observations on the number of abnormal spermatozoa permissible for fertility they should probably be regarded as sterile. They must be regarded as of doubtful fertility, however, since no breeding records were available. Likewise, Nos. 11 and 70, which had abnormal sperm counts of 19-20 per cent., were probably also on the border-line of fertility. No. 132, which had a similar count, had not " settled " any cows over a period of a few months and was subsequently disposed of as sterile. It is probable that the comparatively low percentage of abnormal spermatozoa in cases of epididymitis was due to the primary lesion being in the epididymitis and by the time the testes were affected the canals of the epididymitis were obliterated and no spermatozoa were ejaculated.

Conclusions

The artificial vagina is the most suitable method for testing sperm production of bulls. No difficulty should be experienced in getting a bull to serve the artificial vagina for the first time, even when a cow on heat is not available. Refusal to do so is usually due to faulty sex impulse, poor erection of the penis or injury to the penis.

For a proper estimation of the quality of sperm all the available indices—volume, density and motility of spermatozoa and percentage of abnormal and immature spermatozoa should be considered. In the present investigation, however, density and motility of the spermatozoa were more important than the number of abnormal spermatozoa.

Summary

Two hundred and fifty pure-bred and grade bulls were tested for sperm production and their genital organs examined clinically. Also the testes and epididymes of 82 Zebu bulls were examined clinically.

Of the 250 bulls, 86 (34.4 per cent.) were fertile, 32 (12.8 per cent.) were of " reduced " fertility and 105 (42 per cent.) were sterile. A further 25 bulls (10 per cent.) refused to serve at the time of test. Epididymitis was the most common cause of sterility. There were 78 bulls permanently sterile from this cause. Ten bulls had testicular abnormalities and there were three cases in which the penis was abnormal. Fourteen other bulls which showed no clinical abnormalities in the genital organs produced either no sperm or sperm of very poor motility. On farms where epididymitis existed it was recognised clinically in 44.6 per cent. of the bulls. This condition is capable of fairly rapid development.

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Of the 248 bulls tested, 59 did not serve; three of these bulls had an injury to the penis and were unable to serve. The remaining 56 showed faulty sex impulse and of these 26 had epididymitis and five testicular abnormalities.

A reduction in the volume of the ejaculate was noticed in sterile bulls. The number of spermatozoa per c.m. in fertile bulls was 873,000. In bulls in Group 2 ("reduced" fertility) the concentration of spermatozoa was reduced, and the motility was lowered. Of the 52 bulls with epididymitis that served, five produced dead sperm and seven sperm of feeble activity, and 40 produced no spermatozoa. Of the five bulls with testicular abnormalities that served, two produced no spermatozoa and three spermatozoa of medium to rare density, but of feeble activity. Of 14 bulls which were clinically free from genital abnormalities, eight produced dead spermatozoa of medium density and the others no spermatozoa.

The percentage of abnormal spermatozoa in fertile bulls, in bulls of "reduced" fertility, and in sterile bulls was 8.1, 13.1 and 17.6 per cent. respectively.

Acknowledgment

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SOME EXPERIMENTS UPON THE THERAPEUTIC TREATMENT OF FOWL PARALYSIS (Lymphomatosis) OF POULTRY AND THE VALUE OF IODINE IN RELIEVING THE SYMPTOMS OF SUCH CASES

By ERNEST GRAY
Chelmsford.

DURING an investigation into lymphomatosis or fowl paralysis of poultry during the year 1938-1939 the following observations were made. Streptococcus Viridans was isolated from the great nerve trunks of paralysed birds in over fifty per cent. of the cases examined. Duodenal or cæcal coccidiosis, or both, was almost invariably associated with such cases. In many parasitised but not paralysed, and also in many paralysed birds, the spinal fluid was found infiltrated with small round cells and gave a positive reaction to the soda-lime and Xanthoproteic tests for protein. The naked eye appearance of the nerves of lyphomatosed birds often proved an unreliable guide as to the presence of lymphocytic inflammation, typical cases being found which were not thickened or red in colour, but were in the great majority of cases infiltrated with a serous fluid containing innumerable cells of lymphocytic character.

The infiltration of the spinal fluid was of interest in view of those cases of mild or incubative fowl paralysis in which the premonitary symptom is a drooping of the tail feathers.

Feeding sub-cultures of the original streptococcus isolated combined with coccidial oöcysts and worm eggs to an experimental pen of birds selected from stock known to be free of paralysis resulted in complete paralysis of one bird, the streptococcus being recovered from the great nerve trunks at post-mortem.

Recently an attempt was made to see whether birds could be made to recover from the disease, on the assumption that by raising the leucocytic defences of the body, or administering drugs designed to destroy it, the initial infection with the streptococcus would be overcome; or if this was not the cause of the paralytic symptoms, the leucocytes might be stimulated to remove

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those accumulations of lymphocytes found at post-mortem infiltrating the nerves and highly functioning organs of typical cases.

No reference to the systematic treatment of lymphomatosis or fowl paralysis in poultry has been found in the literature, although Hutyra and Marek in their Special Pathology and Therapeutics of Domestic Animals quote Ellerman and Bang who reported recovery in one case of chicken leukæmia (lymphomatosis?) after treatment with arsenic, but state that it cannot be decided whether or not this did not represent an accidental spontaneous recovery.

The present writer chose the three following therapeutic agents, and administered them in that order.

1. A proprietary preparation Antibacsyn, described as a flocculent suspension of euglobulin adsorbed to a calcic-magnesian saline, designed for use in all cases of endotoxic bacterial infection, and claimed in animals (i.e., quadrupeds) to produce a leucocytosis in six hours and a maximum leucocytosis in twenty hours.

2. A proprietary agent P.A.B.S. (para-amino-benzene-sulphonamide), the new therapeutic agent against streptococci, put up by Messrs. Hewlett in tablets of 7½ grains (0.5 gram).

3. Ten per cent. solutions of Potassium Iodide in distilled water.

Four extremely bad cases brought into the laboratory were used as subjects, and three normal birds, two hens and a cockerel, used as controls. In three of the paralysed birds blood counts, total and proportional, were made before administration of the drugs was begun, and at appropriate intervals afterwards. The fourth bird was actually the first used for experiment, and as it was received collapsed and in extremis an injection of two c.c. of antibacsyn was given at once, and two tablets of P.A.B.S. a day later, blood counts being made from that date. Owing to the frequent withdrawal of blood for examination the wing veins of the birds became severely thrombosed, and the antibacsyn and potassium iodide were therefore injected hypodermically intraperitoneally. The P.A.B.S. was given in two tablet doses orally, after fasting for twelve hours. A minimum period of one day, and in most cases a much longer period, was allowed to elapse between the administration of the three drugs, so that their activity should not merge into one another. In order to eliminate so far as possible external factors, the birds were kept in an old henhouse with straw walls and earth floor and fed only once a day, on a proprietary mash and a handful of grain. Ample water was given, but it was drawn from a stream and not from a tap, and no accessory foodstuffs, minerals or vitamins or greenstuff, were given until after the experiments were complete.

The effect of the administration of these three agents upon the blood picture is shown in table on next page.

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		Erythrocytes per c.m.	Leucocytes per c.m.	Thrombocytes per c.m.	Lymphocytes	Large Mononuclear Leucocytes	Polymorph Leucocytes	Eosinophil Leucocytes	Mast cells
White Leghorn: history of flock of poor doers. Cæcal coccidiosis found in other birds, staphylococci isolated in pure culture from sciatic nerves of one bird.	Normal, 12 p.m.	3.65 million	25,400	17,800	67%	8%	22%	1.5%	1.5%
	Normal, 3.30 p.m.	2.51	20,400	10,900	76%	14%	7%	1%	2%
	6 hrs. after 2 c.c. antibacsyn, 2 p.m.	1.36	17,500	2,500	55%	16%	14%	4%	10%
	20 hrs. after 2 c.c. antibacsyn, 10 p.m.	1.75	15,400	2,400	54%	10%	21%	5%	10%
	6 hrs. after P.A.B.S., 3.30 p.m.	3.14	38,750	9,300	77%	7%	11%	4%	1%
	6 hrs. after 5 c.c. 10% potassium iodide, 3 p.m.	1.48	36,200	9,500	58%	8%	31%	3%	—
	17 hrs. after 10% potassium iodide, 10 a.m.	1.39	27,500	6,190	36%	16%	34%	9%	5%
Rhode Cross: history of cæcal and duodenal cocciodiosis in the flock, large incidence of paralysis. S. viridans isolated from the great nerve trunks of a large number of birds. Cells found in spinal fluid.	6 hrs. after antibacsyn and P.A.B.S., 12 p.m. ...	2.95	15,250	23,100	38%	28%	30%	4%	—
	20 hours after antibacsyn, 10 a.m.	2.06	13,400	2,800	35%	24%	29%	4%	8%
	6 hrs. after 5 c.c. potassium iodide, 4 p.m.	2.02	35,400	16,700	68%	18%	10%	2%	2%
	20 hrs. after 5 c.c. potassium iodide, 10 a.m.	2.41	21,600	3,500	47%	21%	18%	10%	4%
White Leghorn: from the same flock as first bird.	Normal, 11 a.m.	2.65	27,500	20,900	73%	7%	17%	2%	1%
	6 hrs. after 2 c.c. antibacsyn, 4 p.m.	2.70	15,825	6,585	63%	8%	25%	3%	1%
	20 hrs. after 2 c.c. antibacsyn, 10 a.m.	2.04	19,000	380	57%	12%	27%	4%	2%
	6 hrs. after P.A.B.S., 4 p.m.	2.16	14,150	16,300	64%	7%	25%	2%	2%
	6 hrs. after 5 c.c. potassium iodide, 3 p.m.	2.16	22,900	21,300	47%	15%	14%	15%	9%
	17 hrs. after 5 c.c. potassium iodide, 10.30 a.m. ...	2.1	23,750	12,100	85%	4%	8%	2%	1%
Light Sussex: history of chronic cæcal coccidiosis and nephritis in the flock. S. viridans isolated from the nerve trunks of a number of cases.	Normal, 11.30 a.m.	3.59	20,400	9,100	56%	17%	22%	5%	—
	6 hrs. after antibacsyn, 3 p.m.	3.19	20,000	1,400	31%	18%	37%	14%	—
	24 hrs. after antibacsyn, 10 a.m.	3.00	28,700	4,100	36%	10%	47%	7%	—
	6 hrs. after P.A.B.S., 3.40 p.m.	3.47	25,000	20,200	25%	8%	63%	1.5%	1.5%
	6 hrs. after 5 c.c. potassium iodide, 4 p.m.	1.73	17,100	3,700	70%	12%	12%	2%	4%
	19 hrs. after 5 c.c. potassium iodide, 10 a.m.	2.41	33,700	8,000	56%	9%	27%	3%	5%

A3.—White Leghorn, case one on the first blood chart, completely recovered nine days after the first injection of potassium iodide and eight days after the second.

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It will be seen that the effect of the antibacsyn upon three of the four birds was to produce not a leucocytosis but a leucopænia.

A leucocytosis occurred in only one bird. The action of the sulphonamide was variable, whilst that of the potassium iodide solution was to produce a leucosis in three cases and in the fourth to raise the total leucocyte count above that to which it had dropped after administration with antibacsyn and sulphonamide.

An examination of the three controls and of one of the four paralysed birds before treatment revealed in two of the controls and in the diseased bird a drop in the total leucocyte count in the afternoon, a factor to be borne in mind when assessing the value of the above figures.

	Erythocytes millions per c.mm.	Leucocytes per c.mm.	Thrombocytes per c.mm.	Lymphocytes	Large Mononuclear	Polymorphonuclear	Eosinophils	Mast Cells
Normal Hen, a.m. ...	2.75	22,000	6,800	55%	24%	19%	1%	1%
„ „ p.m. ...	2.73	20,000	1,600	18%	35%	34%	13%	—
„ Cock, a.m. ...	2.71	24,200	7,200	41%	16%	31%	6%	—
„ „ p.m. ...	2.28	13,700	15,000	44%	13%	36%	6%	1%
„ „ 20 hrs. after antibacsyn	1.98	12,500	1,800	72%	16%	8%	4%	—
Normal Hen, p.m. ...	1.48	19,000	2,600	50%	17%	29%	2%	2%
„ „ a.m. ...	2.66	15,800	3,800	29%	33%	35%	3%	—
Paralysed Hen, a.m.	3.65	25,400	17,800	67%	8%	22%	1.5%	1.5%
„ „ p.m.	2.51	20,400	10,900	76%	14%	7%	1%	2%

Since the leucopænia induced by antibacsyn was, however, present after seventeen to twenty hours at a morning reading and induced an identical leucopænia in the control bird, a normal cockerel, it is assumed that the action of this agent on the fowl is to depress the hæmopoietic system.

The variable relative counts found indicate that the blood picture of the fowl is an unreliable guide as to the changes taking place in its tissues. It was hoped, for example, that the increase in the lymphocyte percentage after administration of potassium iodide solution, or the appearance of mast cells after injection with antibacsyn, might prove constant and provide a clue as to the particular tissues affected by the drugs; but this did not prove the case. No improvement in the condition of the four birds was noted during the administration of the antibacsyn or the sulphonamide, but after the first injection of potassium iodide they became brighter, and after the second injection muscular tone began to be restored. Within a period of four to seven days after the second injection they completely recovered the use of their legs and could walk, run, flutter and perch with ease. In those birds in which the tail feathers were dropped, these regained their normal upright posture. Several weeks have now elapsed since the first of the birds received the injections, but there are no signs of relapse in any of the four " patients." Two have been returned to the owner's farm. It is proposed to submit the other two to post-mortem examination at the end of six months.

As potassium iodide had produced such results, its effect was tried out on three more birds received in the laboratory in a paralysed state. One was

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a young bird of about ten weeks of age which had completely lost the use of both legs and both wings. The other two were older birds in lay, one very emaciated and scouring loose watery droppings, and the second a hen from a battery brooder affected with loss of control of legs and wings, segments of the tapeworm Davainea and coccidial oöcysts being found in the droppings.

The two latter birds received two injections of five cubic centimetres of a ten per cent. solution of potassium iodide intraperitoneally on two successive days, the ten-week-old pullet, being smaller, receiving two injections intraperitoneally of two and a half c.c. of a ten per cent. solution of potassium iodide, with an interval of thirty-six hours between the injections.

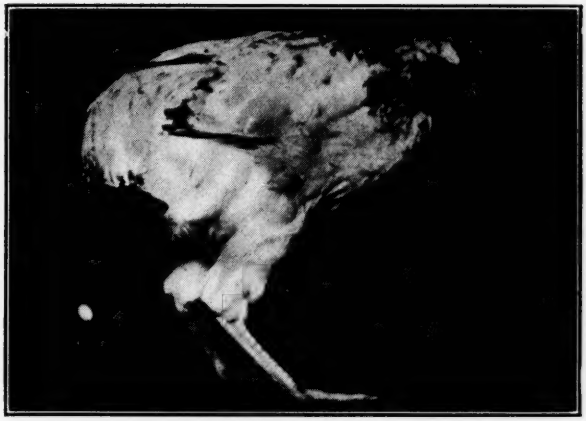
The result of the injections upon the blood picture is as follows:—

	Erythrocytes	White cells	Thrombocytes	Lymphocytes	Large Mononuclears	Polymorphs	Eosins	Mast cells
Chick Normal, 9.30 p.m.	2.00	15,400	10,200	52%	20%	20%	4%	4%
Chick, 6 hrs. after K.I., 4 p.m.	2.42	22,500	20,800	49%	27%	23%	—	1%
Chick, 24 hrs. after K.I., 10.30 a.m.	3.95	26,700	3,500	57%	19%	10%	—	2%
Hen Normal, 10 a.m.	1.83	21,000	32,500	70%	14%	14%	—	2%
Hen, 6 hrs. after K.I., 4.30 p.m.	2.34	25,400	4,200	43%	10%	40%	2%	4%
Hen, 24 hrs. after K.I., 10.45 a.m.	2.34	27,500	40,000	67%	15%	9%	—	9%
Battery Hen, Normal, 10.30 a.m.	2.47	21,000	10,500	60%	13%	25%	1%	1%
Battery Hen, 6 hrs. after K.I., 4.15 p.m.	2.14	27,500	14,200	35%	38%	19%	3%	5%
Battery Hen, 24 hrs. after K.I.	2.71	30,000	26,000	54%	22%	15%	2%	7%

All three birds recovered the use of their legs, but two days later the hen which had been scouring when admitted to the laboratory collapsed and died overnight. At post-mortem a distension of the Bursa of Fabricius was found which had caused accumulation of an enormous mass of fæces in the rectum. The sciatic and brachial nerve trunks were not enlarged to the naked eye, were not œdematous, and both were comparatively free from lymphocytes. A few cells with indistinct nuclei and whose cytoplasm stained only faintly were found by direct smear in the right sciatic nerve. Tapeworms were found in the duodenum, but the bird was otherwise healthy.

The second bird, from the laying battery, also relapsed after recovering the use of its legs and marked catharsis set in. The proprietary medicament Coramine was administered. This contains a carbonic acid radicle and caused stertorous mouth breathing within two minutes of intraperitoneal injection. As tapeworms had been found in the droppings, a worm capsule was administered. The bird then recovered the use of its legs, but was extremely weak and drowsy. The chick made an uneventful recovery.

Eight c.c. of a ten per cent. solution of potassium iodide were given



B1.—Light Sussex chick, case number four on the first blood chart, after administration of Antibacsyn and two days before the first injection of potassium iodide.

B2.—Light Sussex chick, case number four on the first blood chart, three days after the second injection of potassium iodide and five days after the first, showing tail feathers in process of erection.

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hypodermically and intraperitoneally to an eighth case, a pullet of approximately ten weeks old, received collapsed and in a dying condition. During the same night it received an additional severe injury to the right wing. The total blood count after the injury and before the injection of iodine was very high, and a relative count revealed a large percentage of mast cells. The high leucocyte count was of interest in view of the findings of Moore, who found the leucocytes much increased immediately preceding death. In examining the blood of birds suffering from fowl typhoid he found the leucocytes in one case increased from 56,000 the day before death to 115,000 the day of death; in another case they rose from 80,000 to 245,000 in a single day. In this particular case the leucocytosis dropped and the mast cells diminished after injection of potassium iodide.

	Erythrocytes Millions per c.mm.	Leucocytes per c.mm.	Thrombocytes per c.mm.	Lymphocytes	Large Mononuclear	Polymorphonuclear	Eosinophils	Mast cells
After injury	2.41	70,000	17,000	12%	37%	10%	4%	37%
After 8 c.c. K.I.	2.78	27,900	5,500	29%	21%	39%	2%	9%

The pullet lived for a week and recovered sufficiently to take food and water. It did not, however, regain its legs, and subsequently died, an acute nephritis approaching the condition known as Visceral Gout being found at post-mortem.

To sum up, eight paralysed fowls of varying breeds and of ages between ten weeks and a year have received injections of ten per cent. aqueous solutions of potassium iodide, and in seven cases a leucosis has resulted. In five of these uneventful recovery without relapse was the result. One bird died from what may be claimed as an incurable injury, and the seventh made a recovery followed by partial relapse and partial recovery. Injection of potassium iodide solution into the eight case, a dying pullet, brought down the leucocyte count and apparently saved the bird's life for a further week.

Three of the birds received the proprietary agent, Antibacsyn, and leucopænia resulted, as also in a healthy, control, bird. The administration of sulphonamide to four birds caused varying changes in the blood picture, but no improvement in the birds' condition was noted either after injection of antibacsyn or the administration of sulphonamide.

The short summary relating to the diseases present in the flocks from which the first four birds came should be noted. The disease incidence in the particular farms has been known to the writer over the past two years. It would appear that the younger the bird, the greater the chance of complete success. Langdon Brown in his "Physiological Principles of Treatment" remarks that "Nothing could be more reasonable than to use intelligently in disease those very drugs by which the body is enabled to do its own work in health." The dose of potassium iodide received by the seven birds treated

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was one gram, and since the iodine content of potassium iodide is, the head of the Chemistry Department of the Institute informs the author, approximately seventy-six per cent., the amount of iodine received by the cases treated was enormously in excess of that present in basic rations.

It is significant that the five birds which made uneventful recoveries were from flocks with a high incidence of coccidiosis. It brings to mind the iodine and milk treatment of Kerr as a chick coccidiosis preventive. It is also an interesting reflection upon the virus theory of fowl paralysis, for the one bird which died, whether from accident or otherwise, and the one bird which has not made an uneventful recovery, both suffered from tæniasis. If a virus is solely responsible for the nervous lesions and paralytic symptoms of lymphomatosis of poultry, and the presence of parasites has no significance, then it is logical to assume that the iodine injections would have had no effect at all upon the paralysis or caused recovery in every case.

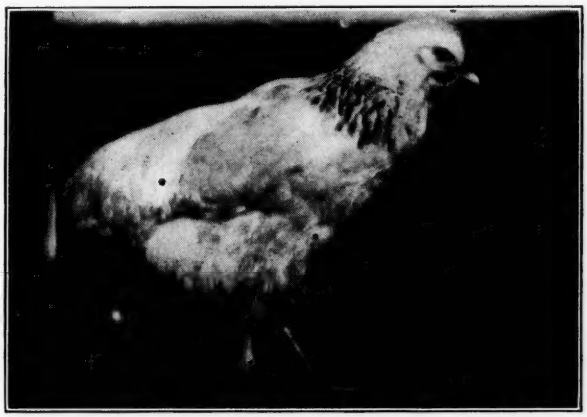
A large number of paralysed and otherwise diseased birds require treatment before the role of iodine as a prophylactic can accurately be assessed; and experiments in the field are now being conducted to this end.

ADDENDUM.—It was omitted to mention that in order to assess the action of the potassium radicle present in the potassium iodide, injections of the equivalent halogen salt potassium chloride were also administered to three other paralysed birds. Since the molecular weight of potassium chloride as compared to potassium iodide is 74.5 to 166, half the dose of potassium chloride was given intraperitoneally in aqueous solution in two successive doses. The effect upon the blood picture was as follows:—

	Red per c.mm.	Whites per c.mm.	Lympho-cytes	Large Mono-Nuclears	Poly-morphs	Eosins	Mast Cells	Thrombo-cytes
NORMAL	2.65	27,500	73%	71%	17%	2%	1%	20,900
18 hrs. after Potassium Chloride	2.1	28,700	60%	17%	12%	4%	7%	4,600
NORMAL	2.47	21,000	60%	13%	25%	1%	1%	10,500
18 hrs. after Potassium Chloride	4.38	29,500	61%	12%	16%	1%	10%	17,500
NORMAL	1.75	21,000	72%	8%	16%	2%	2%	20,400
25 hrs. after Potassium Chloride	3.74	22,500	48%	26%	20%	0%	6%	9,900

A leucocytosis occurred, but no improvement was seen in the state of the birds. It will be noted that in each case the injections were followed by a relative increase in the number of mast cells, and in two instances by an increase in the total red cell count. It would appear, therefore, that the potassium radicle plays a passive role, but that the halogen elements iodine and chlorine stimulated the hæmopoietic system of the birds injected.

C1.—Paralysed Battery Hen, number three on the second blood chart, as received in the laboratory.



C2.—Paralysed Battery Hen, number three on second blood chart, five days after the injections of potassium iodide.

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Abstract

NICOTINIC ACID AND BLACKTONGUE *

VETERINARY practitioners in the Chicago latitude are confronted with borderline case of vitamin B complex deficient canine patients that do not present the typical blacktongue syndrome and there is reason to doubt the etiology in some of these cases. Investigators have shown that nicotinic acid and nicotinic acid amide will cure experimental blacktongue in dogs maintained on a deficient diet which has produced blacktongue. In animals coming to our attention a combination of thiamin chloride and nicotinic acid administered daily for a few days in addition to a well-balanced and complete diet may be rational treatment.

Nicotinic acid and its uses are discussed in the *Merck Service Bulletin.* Nicotinic acid, $C_6H_5NO_2$, is a white, odourless, crystalline powder, chemically known as beta or 3 : pyridinecarboxylic acid. It is stable, non-hygroscopic, and recent studies have shown that it may be autoclaved with no loss of activity. Its solubility is about 1 part to 100 parts of water at 25° C. It is soluble in alcohol and readily soluble in solution of alkali carbonates. Nicotinic acid may be administered orally and preliminary reports indicate that it is practically non-toxic in therapeutic doses.

Nicotinic acid is one of the several components of the vitamin B complex, there being six, vitamin B_1, riboflavin, vitamin B_6 (whose deficiency produces acrodermatitis in rats), nicotinic acid, a "filtrate factor" (whose deficiency produces dermatosis in chicks), and possibly other components in the vitamin B complex.

Following the investigations with nicotinic acid in blacktongue, which is believed to be the canine analogue of pellagra in humans, nicotinic acid was employed therapeutically in pellagra with excellent results. It has been shown that vitamin B_1 (thiamin chloride) and riboflavin, singly or together, are not beneficial and only the nicotinic acid has value. However, nicotinic acid is not therapeutically effective against peripheral neuritis associated with pellagra although this condtiion will respond to treatment with vitamin B_1.

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* *The North American Veterinarian,* January, 1939.

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OBITUARIES

CAPT. W. L. LITTLE, F.R.C.V.S.

It is with much regret that we record the sudden death of Capt. W. L. Little, of Reading, the result of a motor accident. His passing leaves the world poorer, for in Little we had a veterinary surgeon endowed by that great gift of being able to use his power of observation to the fullest extent. Though always in a busy practice, he was able to participate in research work with the practical side of the work well in the forefront. His name will always be associated with the study of the therapeutic treatment of milk fever in cows and the part he played in the evolution of calcium therapy so commonly used in the treatment of that disease to-day. His keen interest in the problem of dietetics of livestock was well known and his contributions to the literature on this and other subjects have always been of outstanding merit and value. Men of the calibre of Little can be ill-spared from the veterinary profession at the present difficult stage of its history. He will stand out as an example of how veterinary surgeons in practice can contribute to the knowledge of disease problems and how observations made by them may lead to results of outstanding and permanent value.

T. D. CONNOCHIE, M.R.C.V.S.

The veterinary profession and the agricultural community in the Border country of Scotland have sustained a sad loss in the passing of T. D. Connochie, of Galashiels. The name of Connochie has long been associated with the profession in Scotland, some generations having been in practice in the South-Eastern counties and in that district the name has become almost a household word among farmers. T. D. Connochie was in practice for over fifty years, first in Selkirk, and mostly in Galashiels. His qualities as a judge of livestock, especially horses, was well recognised and his services at agricultural shows, etc., were always in demand in many districts. His general qualities as a practitioner were of high order and are reflected in the extensive practice he built up in the Border country. A few years ago the agricultural community in the area honoured him by making a suitable presentation to him in recognition of his long association with agricultural enterprises. Time changes many of the aspects of veterinary practice, and the more recently qualified men may view their work from more "modern" points of view: men like Connochie, however, who carried on in the manner of their time and shifted their viewpoint only when they had, by experience, assured themselves of the value of new methods, were and still are the backbone of the veterinary profession.

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Review

The Anærobic Bacteria and their Activities in Nature and Disease. A Subject Bibliography (in two volumes). By ELIZABETH MCCOY and L. S. MCCLUNG. Publishers: U.S.A. (Beverley), University of California Press; London, Cambridge University Press. Price £2 10s. net.

Research workers usually prepare and maintain lists of references for their own use. Such lists are invariably incomplete, and often prolonged search is required to obtain further references bearing on the subject on hand. To research workers on anærobes this work of McCoy and McClung will be of the greatest possible value. It contains lists of references from the year 1816 to 1937, and we are promised further extensions for later years if a demand exists. Volume one contains a chronological author index, the references for each year being arranged alphabetically according to the names of authors. Volume two comprises a number of sections—habitat or occurrence; culture methods; morphology; metabolism; products of metabolism; physiology; serological studies; disease relations; classification. Each section is divided into a number of sub-sections, e.g., the section on cultural methods consists of sub-sections on media, methods of isolation, methods of culture and stock culture and methods. Each sub-section is further divided into various parts—thus the sub-section "methods of isolation" consists of four parts, viz., physical, chemical, biological and miscellaneous. Letters and numerals are used for the various sections, sub-sections and parts, so that if, for example, it is desired to consult references on the physical methods of culturing anærobes the part of the book to read would be that labelled Bc2, and so on. The method of indexing, though it may appear to be somewhat complex, becomes simple after a little experience, and ample instructions are provided.

The authors make no claim that the references are complete, but when it is realised that in all 10,500 original articles from journals, monographs and other published reports have been consulted, and that there are 120,000 entries, it must be assumed that the record is very extensive. It can be well understood that, as the authors say, the preparation of the work has occupied five years in reading and research.

We feel that this work will be welcomed by those interested in anærobes and we express the hope that the demand will be such that extensions will appear in due course.

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News

A NOTE ON THE PUBLICATION "INSTRUCTIONS FOR DEALING WITH RABBITS" IN WAR TIME

In order to encourage the economic use of land in war time, it was found necessary, in 1917, to introduce emergency legislation for the prevention of damage by rabbits. This was repealed in 1921, but the recent and far more satisfactory Prevention of Damage by Rabbits Act lays on occupiers of land the onus of keeping down rabbits.

In order to assist them to comply with this requirement, the promoters of the Act (The Universities' Federation for Animal Welfare) have published exhaustive practical *Instructions for Dealing with Rabbits* (20 pages octavo). The pamphlet gives much detailed information about fumigation, long-netting, rabbit-proof fencing, ferrets and ferreting, shooting, catching with dazzle-light and dog, catching in enclosures, and so on, together with the text of the new Act and a brief and very clear summary of its provisions; the latter will be much appreciated by those who stumble over the rather complex wording of the Act.

Copies of this booklet will be sent on receipt of a stamped quarto envelope, by UFAW, Gordon House, 29, Gordon Square, London, W.C.1.

There may be a danger of rabbits destroyed by poisonous gases getting into the food supply.

Publishers' Notices

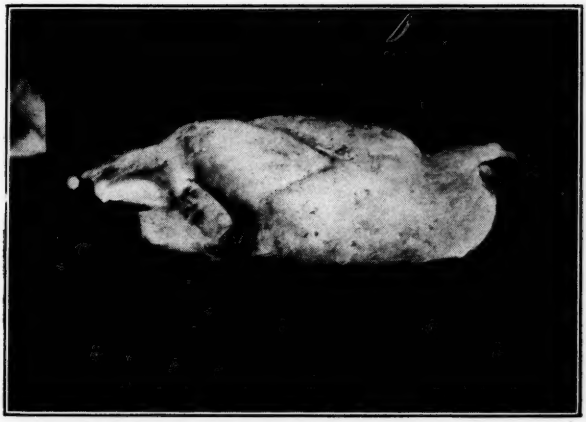
All communications should be addressed to 7 and 8, Henrietta Street, Covent Garden, London, W.C.2. Telephone: Temple Bar 8568. Telegrams: "Baillière Phone, London."

Letters for the Journal, literary contributions, reports, notices, books for review, exchanges, new instruments or materials, and all matter for publication (except advertisements) should be addressed to the Editor.

Copy of advertisements should be in the hands of the publishers—Baillière, Tindall and Cox—not later than the 25th of the month, or if proof is required, not later than the 23rd.

Binding Cases for Volume 95 and any other previous volumes can be obtained from the publishers. Price 2s. 9d. post free.

Annual Subscription, 25s. ($6.00 U.S.A. currency), post free.



A1.—White Leghorn, case one on the first blood chart, as received in the laboratory.

A2.—White Leghorn, case one on the first blood chart, during treatment and after injection with two doses of 5 c.c. 10 per cent. potassium iodide. Photograph taken whilst feeding, showing erected tail feathers.

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